LOGAN CREEK WATER QUALITY STUDY
FISCAL YEAR 1978 REPORT

Submitted To:

U.S.D.A. FOREST SERVICE
FOREST SUPERVISOR
Flathead National Forest
Kalispell, Montana
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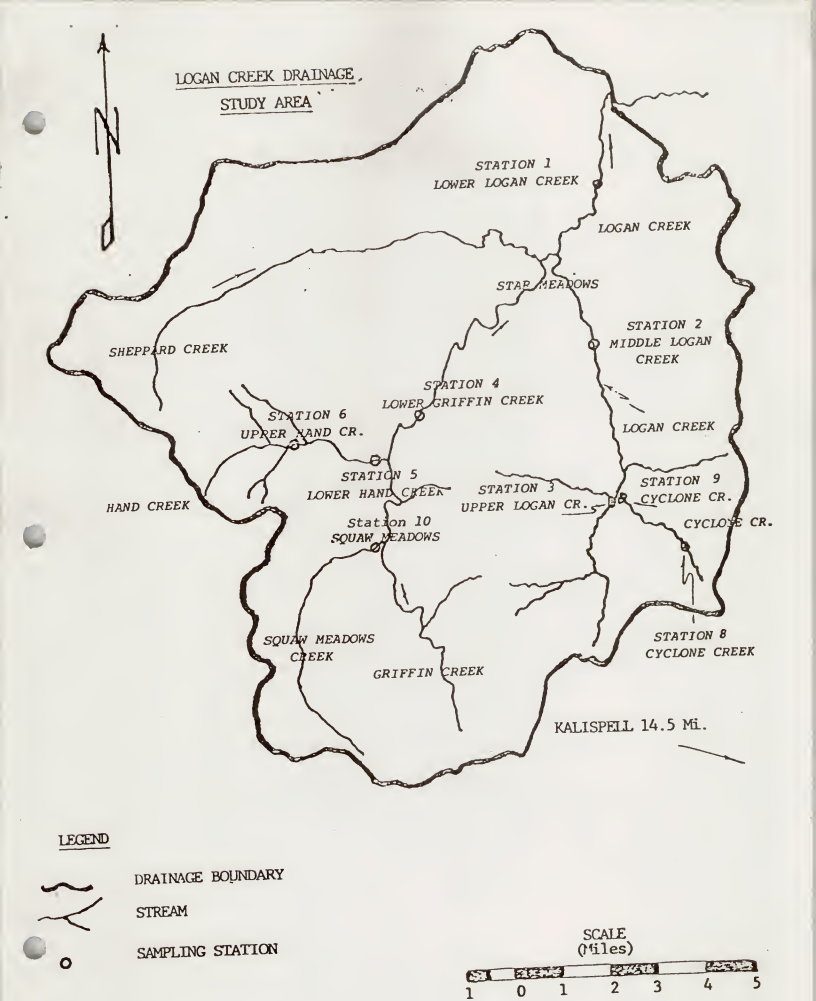
INTRODUCTION

The attached report was prepared by the Montana Department of Health and Environmental Sciences under contract to the Flathead National Forest during fiscal year 1978. It represents a continuation of the study which was undertaken in 1975 and which is published in technical reports prepared by the Montana Water Quality Bureau.

Sample collection and field analyses were accomplished by the Kalispell Regional Office of the Montana Department of Health and Environmental Sciences. Many of the chemical analyses were carried out by the Department's chemistry laboratory in Helena. All samples were collected, preserved and analyzed in accordance with U.S. Environmental Protection Agency recommended methods.

The study area is located on the Tally Lake Ranger District of the Flathead National Forest. For physical information on the drainage the reader should refer to technical report 75-2.


LOGAN CREEK DRAINAGE
STUDY AREA
STATION 1
LOWER LOGAN CREEK
LOGAN CREEK
STAR MEADOWS
STATION 2
MIDDLE LOGAN
CREEK
SHEPPARD CREEK
STATION 4
LOWER GRIFFIN CREEK
STATION 6
UPPER HAND CR.
LOGAN CREEK
STATION 5
LOWER HAND CREEK
STATION 3
UPPER LOGAN CR.
STATION 9
CYCLONE CR.
HAND CREEK
Station 10
SQUAW MEADOWS
CYCLONE CR.
SQUAW MEADOWS
CREEK
STATION 8
CYCLONE CREEK
GRIFFIN CREEK
KALISPELL 14.5 Mi.
LEGEND
DRAINAGE BOUNDARY
STREAM
SAMPLING STATION
SCALE
(Miles)
1 0 1 2 3 4 5

The Sampling Network

The sampling stations are the same throughout this test period as those described in the previous reports with the exception of Station #10, Squaw Meadows Creek. Squaw Meadows Creek was added with the anticipation of increased activity in that drainage.

The sampling point at the Lower Cyclone Creek Station was relocated about 25 yards upstream so the DH-48 sampler could be used.

Comments on Data Collection

Because of the continued problems of maintenance of the thermographs, they have been taken out of service on this project.

At the time of the first sampling trip (May 1, 1977), Station #6 was not accessible as a result of deadfall in the road. Samples collected on July 24 which were shipped to the central laboratory were lost in shipment, and only the data obtained in the field and the regional office laboratory is available.

Because of the reduced number of samples, it is difficult to obtain a sample at or near the peak of the hydrograph for all the streams in the study area. Nevertheless, three samples were collected during the runoff period.

All samples collected for the study were depth integrated composite samples intended to represent a cross-section of the stream at the sampling location.

PART I

PHYSICAL AND CHEMICAL ASSESSMENT

Middle and Upper Logan Creek-Stations 2 and 3

The data collected at these stations reflects virtually no change from previous years. Turbidity and Suspended Sediment during the runoff period were moderately increased at the downstream location. Only trace amounts of Bed Load materials were found at Station 2 during the runoff. Bed Load measurements at Station 3 were consistently below detection limits. Changes in organic color between the two stations is unremarkable, although the runoff values at Station 3 were higher than in previous years.

The concentrations of the chemical parameters examined are in line with what would be expected from the geology. Nutrient levels were consistently near or below detection limits.

Hand Creek-Stations 5 and 6

Turbidity and Suspended Sediment are somewhat reduced from previous years. There seems to be a normal increase in the values of these parameters between the two stations. Unfortunately, the inaccessibility of Station 6 during the early part of the seasons makes it difficult to comment regarding water quality changes between these two stations.

This stream has high concentrations of Organic Color. It is interesting to note that, while most parameters seem to increase downstream, Organic Color is frequently higher at the upstream location.

pH, Alkalinity and Specific Conductance are low in the drainage and are unchanged from previous years. The chemical character of the stream is also unchanged.

Cyclone Creek-Stations 8 and 9

Because of the difficulty in using the DH-48 sampler, the sampling point on Lower Cyclone Creek was moved upstream slightly. Samples were collected at the site of the proposed road crossing.

Examination of the data reflects no changes in water quality in Cyclone Creek. Past logging activities in the headwaters of this drainage seem to have produced no noticable effects on water quality.

Squaw Meadows Creek-Station 10

Large portions of this drainage have become infested with mountain pine beetle. Management plans call for removal of large quantities of timber to control the infestation. A station was located on the lower portion of the creek to monitor the effects on water quality.

The sampling station is located in the NW¼ of Section 15, Township 29 North, Range 25 West. In the original plan for the study of Logan Creek drainage a station at this location was planned as a control station for studying Griffin Creek. This was subsequently rejected because the drainage is heavily grazed, and the effects of agricultural activity would mask those of silvicultural activity. Livestock movement along the stream has accelerated bank erosion in places and the effects of this can be seen in the low water values for Organic Color, Suspended Sediment and Turbidity; which are consistently higher than other area streams. The unusually high Sulfate concentration recorded on June 22 is presumed to be an error in sample handling.

Suggestions for Continued Monitoring

Further sampling of all the streams studied is recommended. In the Hand Creek drainage, these studies should be directed at new activities upstream from Station #6. Monitoring in the Logan-Cyclone area should be continued as roads are built into this previously roadless area. The effect of the removal of infested pine should be studied in the Squaw Meadows drainage.

Several stations should be established on Sheppard Creek. Accelerated timber harvest is being planned in this drainage as a result of insect infestation.

In view of budget limitations and the prospect of adding new sampling stations, the question of which parameters to study should be addressed. The chemical parameters which were added during 1976 to conform to the Benchmark system have remained unchanged. Because of the analytical costs associated with these parameters, their value to the study must be questioned. Bed Load and Nutrients have been near detection limits at most times, but because of the particular significance of these parameters they should be retained. The principal thrust of the project should be towards those parameters which best reflect the impact of silvicultural activities, namely Suspended Sediment, Turbidity and Organic Color.

APPENDIX I
PHYSICAL AND CHEMICAL DATA

FLOW (cfs)

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	40	90	25	28	21
#3 UPPER LOGAN CR.	15	28	11	9	2.5
#5 LOWER HAND CR.	75	80	15	10	8
#6 UPPER HAND CR.	-	32	5	2.5	1.8
#8 UPPER CYCLONE CR.	2.8	2.5	2.2	1.0	1.2
#9 LOWER CYCLONE CR.	2.5	1.5	<1	<1	<1
#10 SQUAW MEADOWS CR.	3.5	20	2.0	2.0	1.8

GAUGE HEIGHT (ft.)

#2 MIDDLE LOGAN CR.	1.44	1.57	1.30	1.30	0.94
#3 UPPER LOGAN CR.	0.86	0.94	0.72	0.60	0.40
#5 LOWER HAND CR.	2.40	2.40	1.56	1.20	1.14
#6 UPPER HAND CR.	-	1.45	1.10	0.98	0.96
#8 UPPER CYCLONE CR.	1.44	1.44	1.42	1.17	1.20
#9 LOWER CYCLONE CR.	---	---	---	---	---
#10 SQUAW MEADOWS CR.	---	---	---	---	---

TURBIDITY (NTU)

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	2.5	2.0	0.6	0.3	0.3
#3 UPPER LOGAN CR.	1.7	1.2	0.8	0.4	0.3
#5 LOWER HAND CR.	2.0	1.7	0.9	0.6	0.4
#6 UPPER HAND CR.	-	0.8	0.6	0.3	0.3
#8 UPPER CYCLONE CR.	2.5	0.6	0.4	0.3	0.1
#9 LOWER CYCLONE CR.	1.5	1.1	0.6	0.6	0.6
#10 SQUAW MEADOWS CR.	1.8	2.2	1.8	1.7	2.0

TOTAL SUSPENDED SEDIMENT (mg/l)

#2 MIDDLE LOGAN CR.	15	18	0	0	0
#3 UPPER LOGAN CR.	2	8	0	0	0
#5 LOWER HAND CR.	16	16	0	0	0
#6 UPPER HAND CR.	-	5	0	0	0
#8 UPPER CYCLONE CR.	23	20	0	0	0
#9 LOWER CYCLONE CR.	13	19	0	0	0
#10 SQUAW MEADOWS CR.	9	22	1	0	2

BED LOAD (oz)

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	tr.	tr.	0	0	0
#3 UPPER LOGAN CR.	0	0	0	0	0
#5 LOWER HAND CR.	tr.	tr.	0	0	0
#6 UPPER HAND CR.	-	0	0	0	0
#8 UPPER CYCLONE CR.	0	0	0	0	0
#9 LOWER CYCLONE CR.	0	0	0	0	0
#10 SQUAW MEADOWS CR.	0	0	0	0	0

SPECIFIC CONDUCTANCE (μmhos)

#2 MIDDLE LOGAN CR.	225	200	260	230	220
#3 UPPER LOGAN CR.	220	160	175	200	220
#5 LOWER HAND CR.	40	29	46	36	33
#6 UPPER HAND CR.	-	21	24	26	30
#8 UPPER CYCLONE CR.	280	270	285	245	245
#9 LOWER CYCLONE CR.	260	280	315	290	275
#10 SQUAW MEADOWS CR.	29	33	43	40	38

TEMPERATURE (°F)

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	36	40	44	51	59
#3 UPPER LOGAN CR.	34	37	45	50	57
#5 LOWER HAND CR.	36	40	41	53	59
#6 UPPER HAND CR.	-	38	40	53	57
#8 UPPER CYCLONE CR.	34	37	42	48	50
#9 LOWER CYCLONE CR.	34	36	43	48	49
#10 SQUAW MEADOWS CR.	38	39	45	54	60

ORGANIC COLOR (Pt-Co Units)

#2 MIDDLE LOGAN CR.	32	40	10	5	5
#3 UPPER LOGAN CR.	37	40	10	5	0
#5 LOWER HAND CR.	55	55	10	10	0
#6 UPPER HAND CR.	-	25	25	10	5
#8 UPPER CYCLONE CR.	35	25	10	5	5
#9 LOWER CYCLONE CR.	30	30	15	5	5
#10 SQUAW MEADOWS CR.	65	75	40	30	25

pH

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	7.50	7.90	8.14	8.20	7.87
#3 UPPER LOGAN CR.	7.40	7.08	7.85	7.80	7.66
#5 LOWER HAND CR.	6.35	6.35	7.15	7.22	7.24
#6 UPPER HAND CR.	-	6.03	7.05	7.19	7.11
#8 UPPER CYCLONE CR.	7.30	7.35	8.15	8.22	8.02
#9 LOWER CYCLONE CR.	7.46	7.49	8.20	7.95	8.00
#10 SQUAW MEADOWS CR.	6.25	6.28	7.31	7.28	7.23

ALKALINITY (mg/l $CaCO_3$)

#2 MIDDLE LOGAN CR.	110	113	162	171	173
#3 UPPER LOGAN CR.	88	81	125	124	124
#5 LOWER HAND CR.	11	12	21	23	16
#6 UPPER HAND CR.		5	11	11	12
#8 UPPER CYCLONE CR.	148	144	187	185	188
#9 LOWER CYCLONE CR.	137	154	175	179	188
#10 SQUAW MEADOWS CR.	8	11	19	20	18

CALCIUM (mg/l)

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	30.0	30.0	46.2		51.0
#3 UPPER LOGAN CR.	27.2	13.5	38.0		41.0
#5 LOWER HAND CR.	1.0	3.1	4.4		4.5
#6 UPPER HAND CR.	-	2.1	2.8		2.6
#8 UPPER CYCLONE CR.	43.9	44.4	53.3		58.0
#9 LOWER CYCLONE CR.	43.3	45.0	54.5		58.0
#10 SQUAW MEADOWS CR.	1.0	3.3	5.6		4.5

MAGNESIUM (mg/l)

#2 MIDDLE LOGAN CR.	6.8	7.2	8.4		11.0
#3 UPPER LOGAN CR.	4.7	11.6	6.6		7.3
#5 LOWER HAND CR.	1.2	0.8	1.5		1.3
#6 UPPER HAND CR.	-	0.3	0.0		0.7
#8 UPPER CYCLONE CR.	8.2	9.6	9.4		12.0
#9 LOWER CYCLONE CR.	8.5	9.7	10.3		12.0
#10 SQUAW MEADOWS CR.	0.8	0.9	0.0		1.3

SODIUM (mg/l)

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	2.0	1.4	1.7		1.9
#3 UPPER LOGAN CR.	1.7	1.3	1.3		1.5
#5 LOWER HAND CR.	2.0	1.7	2.2		2.6
#6 UPPER HAND CR.		1.5	1.9		2.6
#8 UPPER CYCLONE CR.	1.9	1.8	1.4		1.8
#9 LOWER CYCLONE CR.	2.0	1.8	1.8		1.8
#10 SQUAW MEADOWS CR.	2.3	2.5	2.7		3.1

POTASSIUM (mg/l)

#2 MIDDLE LOGAN CR.	1.0	0.3	1.1		1.3
#3 UPPER LOGAN CR.	0.8	0.3	0.9		1.1
#5 LOWER HAND CR.	0.7	0.3	0.8		1.0
#6 UPPER HAND CR.		0.3	0.7		0.7
#8 UPPER CYCLONE CR.	1.2	0.8	1.3		1.6
#9 LOWER CYCLONE CR.	1.0	0.8	1.5		1.6
#10 SQUAW MEADOWS CR.	0.8	0.4	1.1		1.5

CHLORIDE (mg/l)

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	0.8	0.5	0.5		0.6
#3 UPPER LOGAN CR.	0.4	0.4	0.4		0.2
#5 LOWER HAND CR.	0.6	0.5	0.3		0.5
#6 UPPER HAND CR.		0.6	0.3		1.4
#8 UPPER CYCLONE CR.	0.6	0.6	0.4		0.6
#9 LOWER CYCLONE CR.	0.6	0.7	0.3		0.6
#10 SQUAW MEADOWS CR.	0.9	0.9	0.5		1.2

SULFATE (mg/l)

#2 MIDDLE LOGAN CR.	2.5	1.6	2.3		0.3
#3 UPPER LOGAN CR.	2.9	1.8	1.8		3.2
#5 LOWER HAND CR.	2.6	1.6	1.9		2.6
#6 UPPER HAND CR.		1.4	2.1		2.9
#8 UPPER CYCLONE CR.	2.6	1.4	1.7		3.1
#9 LOWER CYCLONE CR.	2.7	1.8	0.0		0.3
#10 SQUAW MEADOWS CR.	2.7	2.0	47.1		0.3

NITRATE + NITRITE (mg/l)

	5/1/78	5/24/78	6/22/78	7/24/78	8/15/78
#2 MIDDLE LOGAN CR.	0.09	0.03	0.01		0.01
#3 UPPER LOGAN CR.	0.05	0.02	0.01		0.02
#5 LOWER HAND CR.	< 0.01	0.02	<0.01		<0.01
#6 UPPER HAND CR.	-	0.01	<0.01		<0.01
#8 UPPER CYCLONE CR.	0.36	0.07	0.03		<0.01
#9 LOWER CYCLONE CR.	0.33	0.06	0.02		<0.01
#10 SQUAW MEADOWS CR.	<0.01	0.013	0.01		<0.01

ORTHO-PHOSPHATE (mg/l)

#2 MIDDLE LOGAN CR.	<0.001	0.014	<0.001		0.003
#3 UPPER LOGAN CR.	0.05	0.013	<0.001		0.004
#5 LOWER HAND CR.	<0.001	0.012	<0.001		0.002
#6 UPPER HAND CR.	-	0.012	<0.001		0.002
#8 UPPER CYCLONE CR.	<0.001	0.011	<0.001		1.000
#9 LOWER CYCLONE CR.	<0.001	0.010	<0.001		0.001
#10 SQUAW MEADOWS CR.	<0.001	0.01	<0.001		0.004

APPENDIX II
METHODS OF ANALYSIS

1. Total Suspended Sediment

Total Suspended Sediment was determined by the gravimetric procedure as described in Section 208D, 14th Edition, "Standard Methods for the Examination of Water and Wastewater", Page 94.

2. Turbidity

Turbidity was determined using a Hach 2100A turbidimeter.

3. Specific Conductivity

Specific Conductivity was determined by means of a Balsbaugh type 100 Wide Range Conductivity Bridge.

4. Laboratory pH

pH was determined with a Corning Model 110 Digital Expanded Scale pH meter with corrections for temperature and slope.

5. Water Temperature

Water temperature was determined by means of a calibrated hand held thermometer.

6. Organic Color

Organic Color was determined by use of a Hach Model CO-1 Color Comparator reading platinum cobalt units from 0 to 100.

7. Flow Rate

Flows were determined using a Gurley Pigmy Meter. Stations were selected for uniform flow across regular section with a minimum of debris or boulders. Lateral spacings varied from 2 feet to 6 inches depending on the size of the stream.

8. Nitrate + Nitrite

This analysis was conducted by the automated Hydrazine Reduction Method.

9. Ortho Phosphate

Ortho phosphate was determined by the Automated Colorometric Ascorbic Acid Reduction Method as described in the EPA "Manual of Methods of Chemical Analysis of Water and Wastes", Page 256ff.

10. Alkalinity

Alkalinity was determined by titration to a colorometric end point with a standard acid as described in Section 403 of the 14th Edition, "Standards Methods for the Analysis of Water and Wastewater", Page 278ff.

11. Bicarbonate

Bicarbonate was determined by calculation based on the alkalinity determinations.

12. Calcium, Magnesium, Total Hardness

EDTA titrations were used to determine calcium and total hardness. Magnesium was calculated as the difference between the two. The procedure is described as Method 313C in the 14th Edition of "Standards for the Analysis of Water and Wastewater", Page 223ff.

13. Sodium

Sodium concentrations were determined using an Atomic Absorption Spectrophotometer.

14. Chloride

Chloride was determined by the Automated Ferrous Cyanide Technique using a Technicon Autoanalyzer.

15. Sulfate

Sulfate concentrations were determined by the Automated Turbidimetric method.